# Deep Learning Assignment Report

## 1. Overview

This report presents the implementation of a Feedforward Neural Network (FNN) trained on the Caltech-256 dataset. The model is built to classify images into various object categories, leveraging different architectures, optimizers, and hyperparameter tuning for performance evaluation.

## 2. Dataset Details

Dataset Used: Caltech-256  
Number of Classes: 256  
Image Size: Variable  
Training Set: 70% of images  
Validation Set: 15% of images  
Test Set: 15% of images

## 3. Model Implementation

Model Type: Convolutional Neural Network (CNN)  
Architectures Used: Different CNN architectures with varying depths  
Activation Functions: ReLU  
Optimizers Tested: SGD, Adam, RMSprop, Nesterov  
Loss Functions: Cross-Entropy Loss  
Batch Sizes: 32  
Learning Rates: 0.001  
Dropout: Used to prevent overfitting

## 4. Training and Evaluation

The model was trained for multiple epochs with different optimizer settings.  
Training and validation accuracy and loss were observed for performance assessment.  
Confusion matrix was generated to analyze classification performance.  
Visualization of sample images from the dataset was performed.

## 5. Results and Analysis

The best-performing configuration for the CNN model was:  
- Optimizer: Adam  
- Learning Rate: 0.001  
- Batch Size: 32  
- Validation Accuracy: Achieved a high accuracy with lower loss values.  
The confusion matrix showed some misclassified classes, which were analyzed for further improvements.

## 6. Conclusion

The implemented CNN model demonstrated strong performance on the Caltech-256 dataset. Further improvements can be made by fine-tuning hyperparameters, using data augmentation techniques, and implementing transfer learning with pre-trained models for enhanced accuracy.